Technical Disclosure Commons

Defensive Publications Series

October 17, 2018

# COMBINED LOW- AND HIGH-VOLTAGE FAN INTEGRATED IN A JOINT FRAME FOR A COOLING SYSTEM OF A FULL CELL VEHICLE

Verena Schwaiger
*Bertrandt Ingenieurbüro GmbH*



# COMBINED LOW- AND HIGH-VOLTAGE FAN INTEGRATED IN A JOINT FRAME FOR A COOLING SYSTEM OF A FULL CELL VEHICLE

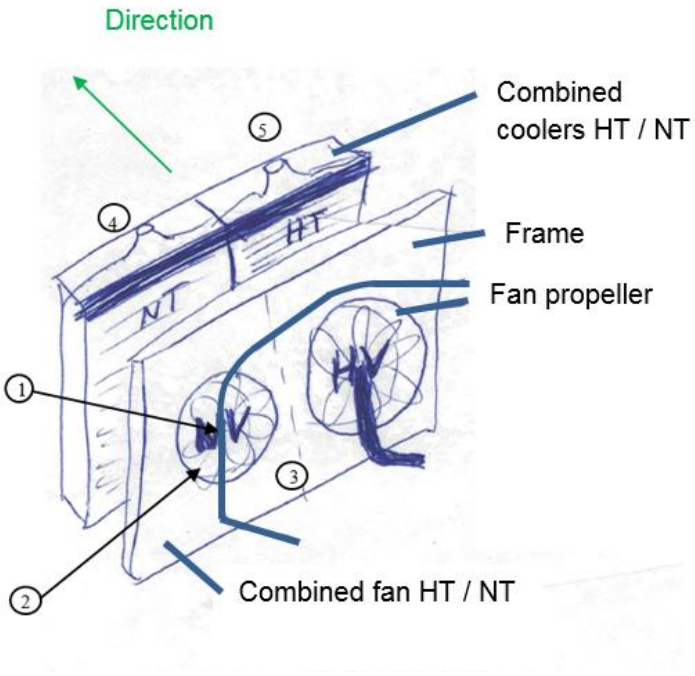
**Technical Task:**
Low-voltage (LV) 12V radiator fans are used for engine cooling in conventional coolant circuits. In the case of electrified vehicles, high-voltage ventilators (HV) with higher voltages are sometimes used. These types of fans mainly consist of components with centrally located fan motor **(1)**, rotating fan blade **(2)** and the fan frame **(3)**.

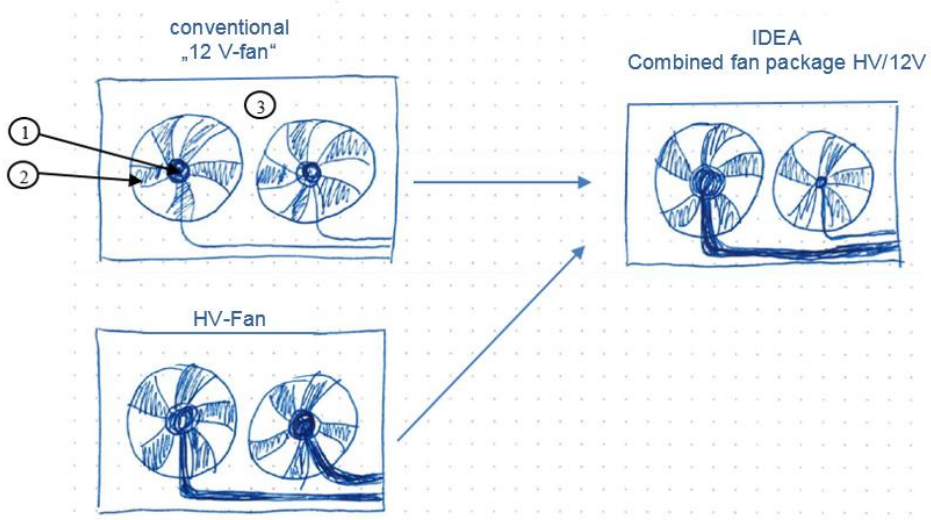
The fan blows (arrangement: fan behind the cooler, in the direction of travel) the ambient air in axial direction through the radiator-condenser fan pack. In this case (higher required cooling air mass flow), fan packages with two juxtaposed fan wheels (either low or high voltage in the type-specific installation) are installed. The wattage of the fan motors determines their performance and the cooling air flow.

This is why for hydrogen vehicles, for a functional purpose, there are two separate coolant circuits. For this, there are LT- (low-temperature) and HT (high-temperature) coolers. These are – as seen in conventional vehicles – arranged one behind the other (in the direction of travel).

**Initial Situation:**
Due to the sequential arrangement of the radiator (seen one behind the other in the direction of travel), there is an increased pressure loss. This is why stronger fans with higher wattage are needed.
In addition, when using two HV fans, there is an increased energy demand that reduces the range of hybrid or fuel cell vehicles.
Furthermore, due to the architecture of the fan with its centrally located fan mark and the larger design of the motors in HV fans over 12V fans, there is an additional pressure loss.
In addition, LT and HT circles always have a dependence on each other due to the geometric arrangement. If the HT circuit requires e.g. more cooling air mass flow, this is also increased by the LT cooler, although this might not be necessary. Likewise, this dependence is reversed. In the worst case, this is even counterproductive if a circle is to keep the temperature. Both fan blades then always rotate at the same speed.

**Solution:**
There are in a joint, uniform frame next to each other both a HV and a NV fan. This combined ventilator then sits behind (seen in the direction of travel) a likewise juxtaposed NT (4) - / HT (5) – combined cooler. Thus, the LV fan is located behind the LT cooler and the HV fan behind the HT cooler package.






**Advantages:**

- Lower pressure loss due to the radiator / fan pack due to
  - the package arrangement next to each other and not in a row
  - the smaller hub of the LV fan compared to a pure HV fan package
- Lower energy consumption than two HV fans (longer range)
  LT and HT circuits can be independently and ideally controlled. If the HT circuit thus requires more cooling air mass flow, this can be controlled without any influence on the NT cooling system. Conversely, if only the NT cooling circuit requires cooling (for example, charging the battery only charges NT circuit). Thus, e.g. faster and more efficient charging possible without additional energy loss.